

Changes to the HCAL code

In last weeks “talk”, I presented an outline of the code that Tully/Monteiro kindly wrote for us.

since then, I’ve gone thru the talk with John Elias (hcal electronics guy)

in this talk, I just list the changes I think need to be implemented to bring the software and hardware into agreement...

changes to Hcal Code

questions?

1) (Chris Seez asks...) should these changes go in for the ORCA 4 release (end feb) and thus for the june 5 milestone, or should we wait until the next release?

let's consider this at the end...

jitter

in the code, there is a variable which takes into account the difference between the expected arrival time of the energy in a given layer, and the actual arrival time (especially, energy might arrive late if its due to slow neutrons, etc), and the effect this has on the pulse shape. in the old code, this feature is turned off in the hcal because of the way the old GEANT files were generated.

because we will be using GEANT with both the old timing and the new timing for quite some time, we ask that there be a flag that we can use to set/unset the "jitter" variable in EcalRUFromReadoutSimulation.

basic pulse shape

currently, ORCA uses the same pulse shape in the HCAL and the HF. However, the HF has a very quick response. We request that the HF pulse shape be changed so that all the energy is deposited in one time bucket.

shaping due to preamp in hcal

We wish to change the functional form of the preamplifier shaping structure for the HCAL from $t \cdot \exp(-(t/\tau)^2)$, $\tau=25$ ns to
**** john elias needs to provide this ****

photostatistics

We suspect that the effect of photostatistics may be important for energy deposits less than about 5 GeV. So, we think this may be important enough that we would like to add this for the next round of simulation. So, we ask that the energy in each time bucket be round to integer values using the conversion

*** john elias will provide the conversions ***
and then fluctuated using poisson statistics

$$t=0$$

the variable "bintime" is currently adjusted so that for a pulse due to "on-time" energy, the maximum occurs in the 5th time bucket of a timesample, with a distribution

4th bucket: 5% of pulse, 5th bucket: 70 % of pulse, 6th bucket: 25% of pulse, 7th bucket 2.5% of pulse.

it is adjusted by a variable

which is currently set to 32 ns for hcal, 47.6683 for ecal.

for the hcal, we would

like the 32 changed until we get the following distribution

5th bucket: 47%, 6th bucket: 47%, 7th bucket: 6%

(elias thought that tully's calculation that gave the other as optimum might be wrong for us, because photostatistics is a bigger effect for us, so that the time slices are less correlated)

weights

we would like the weights, used by evalAmplitude, to be settable external to the program. Chris currently has the weights set to 0,-0.208,-0.208,-0.208,-0.138,0.942,0.201,-0.174,-0.207,0.

We would like to experimenta with

0,0,0,-1.5,-1.5,1,1,1,0,0 and

0,0,0,-1,-1,1,1,0,0,0

reasoning similar to that on previous slide

quantization due to ADC

for the VF, the quantization due to the adc has a major effect, since least count is 2.5 GeV. We ask that this quantization be added to each time bucket of the "timesample" object.

jitter due to optics

each of the (currently 4) radial layers in the hcal is made up of many layers of scintillator. the light from each of these layers does not arrive at the photo diode at the same time. we ask that some sort of offset be added that depends on the scintillator layer number for "bintime" to take into account the effect of this "jitter". We currently do not know how big these "jitters" are, so we ask that they be easily settable, perhaps through environmental variables (ie, settable external to the code)

hcal segmentation

*shuichi, need your input here *** the current geometry artificially has 4 radial layers in the hcal, because of a study now completed. however, in reality, what are current the 3rd and 4th radial layers in the ORCA geometry are in reality ganged into one radial layer. We would like to change the geometry file so that there are only 3 layers in the HB, to reflect this. For the HE, we want the same thing with GEANT layers 2 and 3

Hcal Geometry

however, if we stick with 4 radial layers, we need to change their depths from 180,190,300,320 to 180,190,287,406

L1 primitives

for the L1 trigger primitive, hcal depth 4 in the HB should not be used.

L1 bunch id

we currently have not finished the studies to tell us if we need a Jitter for class EvalAmplitude, like the ecal uses to determine the bunch crossing (do not confuse this jitter with the jitter variable in EcalRUFromReadoutSimulation). for now, we would like a flag we could use to turn such a thing on and off.

see next talk

Hcal electronic segmentation

assuming we still have 4 hcal radial layers in hb,

*** need input here*** do we sum the time samples for the first 3 layers, then extract the energy, then apply some average sampling correction, or do we extract the energy from each layer, apply the sampling correction for that layer, and then sum? what is done in the hardware?

what to do now?